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Forward Osmosis Bag (FOB) Flight Experiment

- In 2011 NASA **FOB flight test** on the Space Shuttle (**STS 135**).
- FOB was a water purification device for the recovery of a potable drink from wastewater in microgravity (like the LWC)
- Objective: **to verify that forward osmosis works in microgravity** and evaluate the effects of micro-scale buoyancy driven mixing.
- Flux rate and salt rejection determined at 6- and 24-hour intervals.



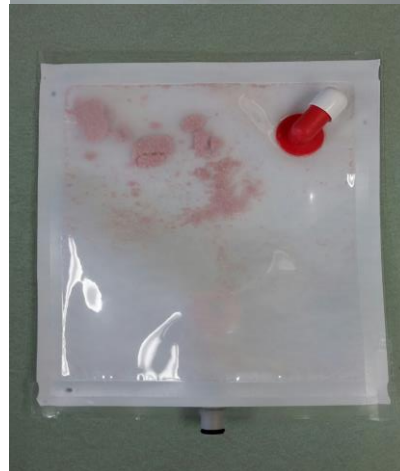


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PERSONAL WATER RECLAMATION SYSTEM (PWRS)

Intended for personal urine recycling and water recovery during water emergencies.





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South Pole Energy Challenge

“Robert Swan, the first person in history to walk to both the North and South Poles. Swan has dedicated his life to the preservation of Antarctica by the promotion of recycling, renewable energy and sustainability to combat the effects of climate change”





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Lets preserve Antarctica...



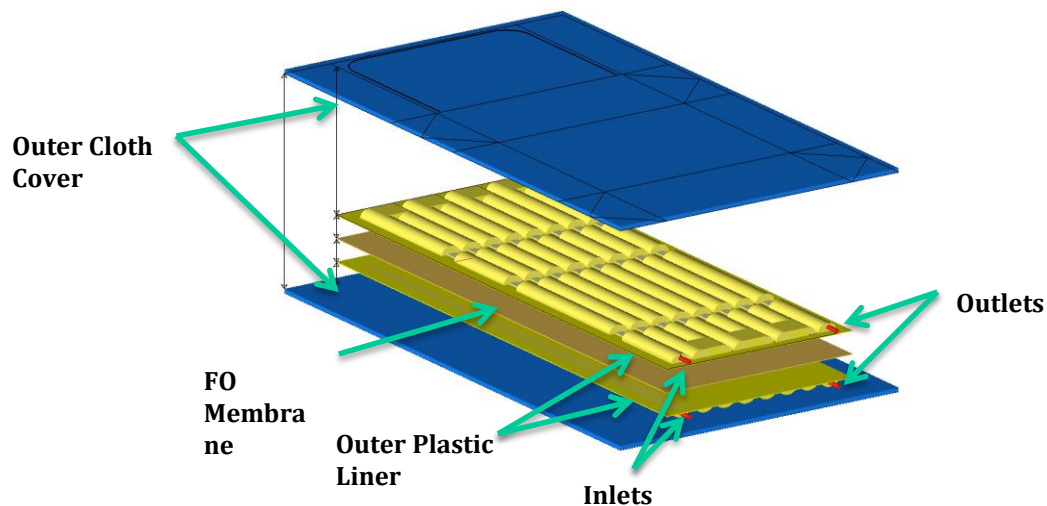


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CARGO TRANSFER BAG (CTB)

- CTB is an embedded **forward osmosis membrane** water treatment element **inside of a cargo transfer bag**.
- CTBs are cloth bags used to deliver cargo to orbit in the current international human space flight logistics system;
- CTBs are used for emergency backup water treatment and radiation shielding.

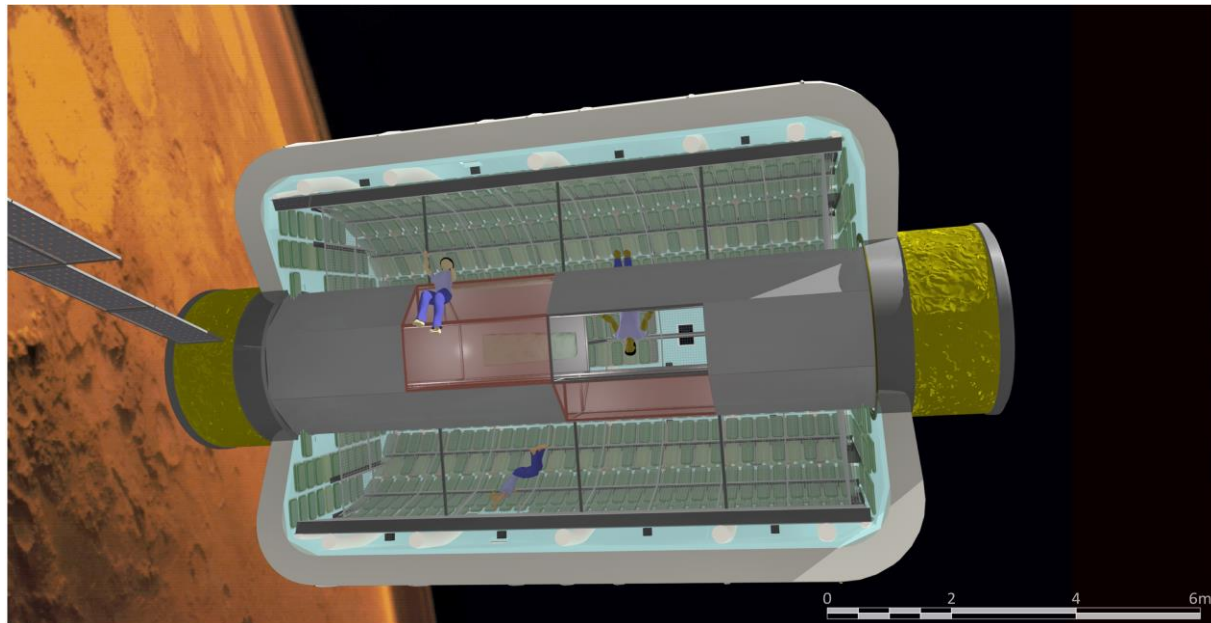




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WATER WALLS (WW)





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Ames

Discovery • Innovations • Solutions

STANDARD W.W. BAG UNIT

POLYETHYLENE BAG WITH ONE OR
MORE SPECIALIZED MEMBRANES

BAG: 25 CM x 50 CM
POUCH: 22.5 CM x 45 CM

T-BEAMS SPAN BETWEEN
INNER CURVATURE OF
RIGIDIZED HOOP STRUCTURE.
T-BEAM FLANGES ABUT,
WHILE STANDOFF WEB IS
INTERRUPTED FOR TUBE AND
LIGHTING RACEWAY

FRONT AND BACK LAYERS OF
ARRAYED BAGS OFFSET TO
PROVIDE OVERLAP AT EDGES
+ PROVIDE CONTINUOUS
RADIATION PROTECTION



INDIVIDUAL W.W. BAGS ARRAYED IN POCKETED MESH PANEL

MESH ALLOWS AIR + LIGHT TO REACH BAGS

IN/OUT PORTS W/TUBES

SEWN SEAM SEPARATING
POCKETS

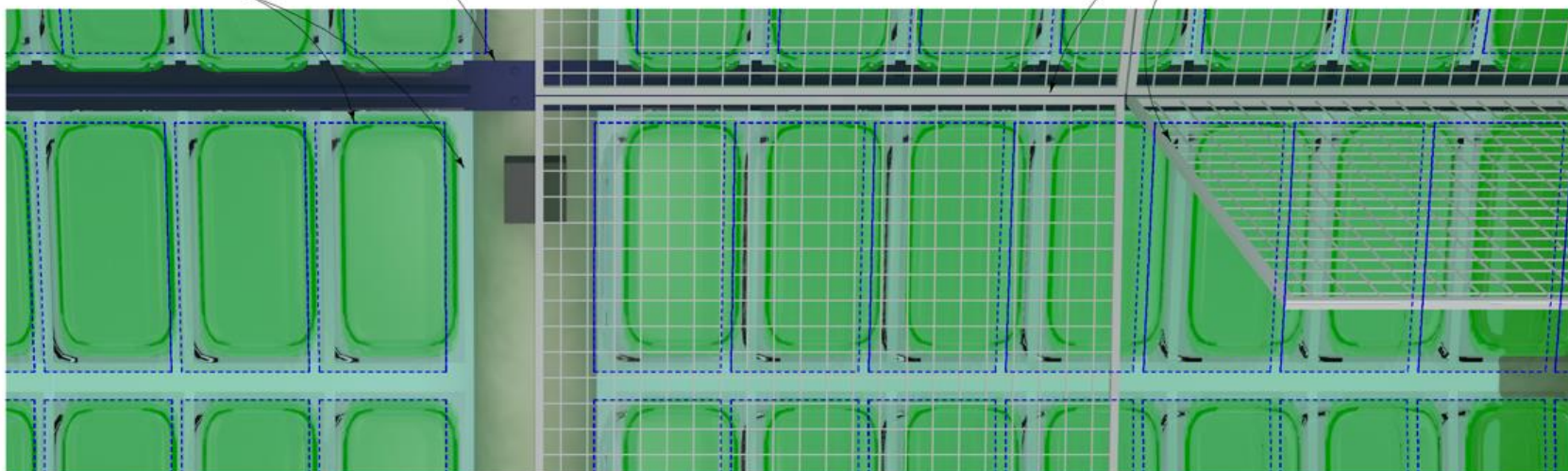
W.W. BAGS SECURED IN INDIVIDUAL
MESH POCKET AFFIXED TO OPEN
MESH BACK PANEL

SNAPPED CLOSURES AT TOP AND
BOTTOM OF EACH POCKET FOR
SECURE ACCESS

HARD OPEN-GRID PANELS
PROTECT ARRAY OF W.W. BAGS.
PANEL HINGED AT T-BEAM
STANDOFF WEB FOR ACCESS



WATER WALLS BAG INSTALLATION



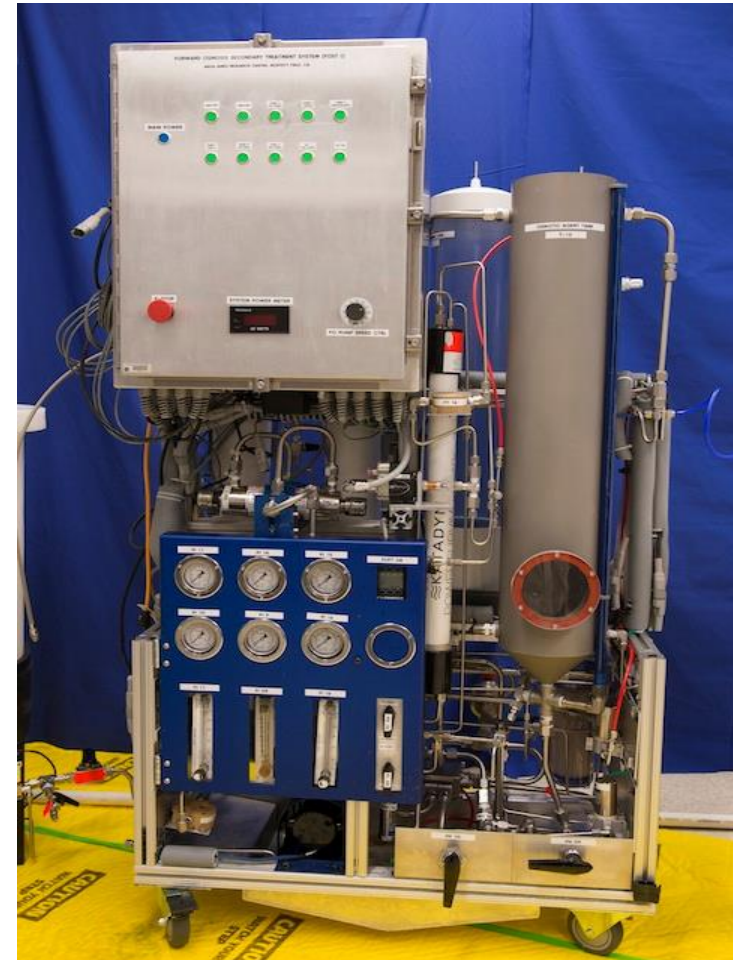


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FORWARD OSMOSIS SECONDARY TREATMENT (FOST)

- FOST was designed to treat the effluent of a membrane aerated **bio-Reactor** (MBAR).
- The feed to MBAR was urine, humidity condensate, and grey water.
- The FOST system functions as a post treatment step to the bioreactor.
- It also provides a physical barrier to microbial and viral contamination.

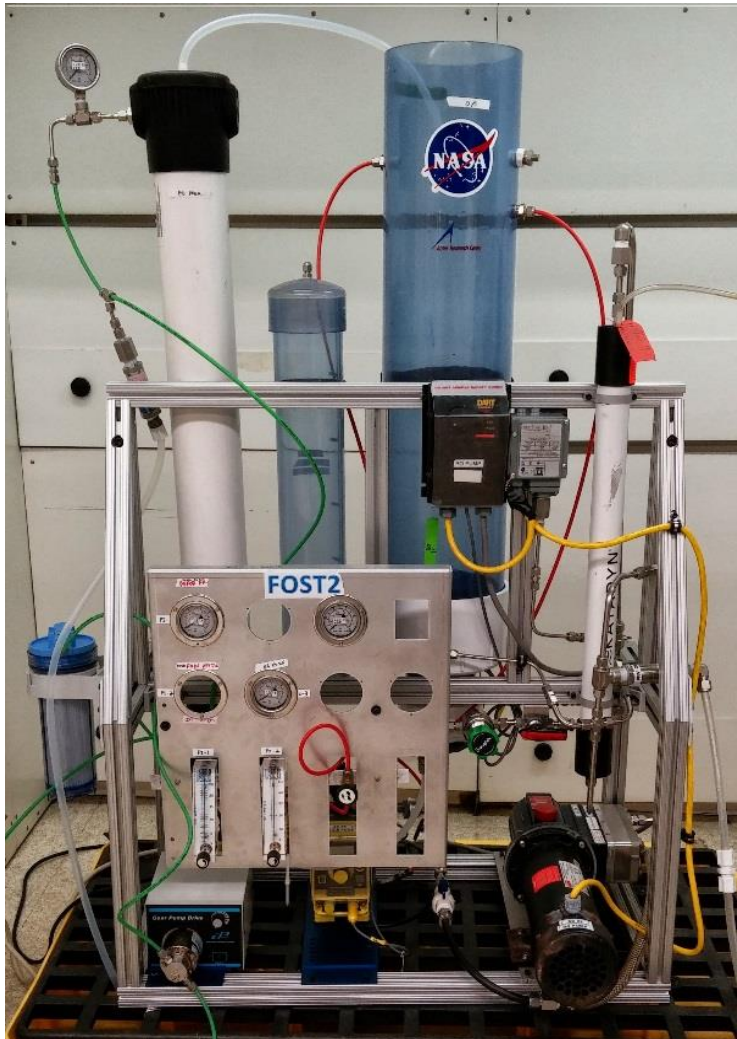




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FOST 2 – Different FO membranes



↓
Urine

↓
**Osmotic
agent**

↓
Product



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Sustainability Base Building at NASA-ARC

- Gray water recycling system

